

GEMS

Space Science Sequence

Concept and Lesson Map



Bibliography

Aik-Ling, T., Yew-Jin, L. & Leeuwen, T. (2009). Ready, Set, SCIENCE!: Putting Research to Work in K-8 Science Classrooms. Washington, DC: The National Academies Press.

Read online: http://www.nap.edu/openbook.php?record_id=11882

American Association for the Advancement of Science (2001). Atlas of science literacy. Washington DC: NSTA Press.

Read Online: adaptation at <http://strandmaps.nsd.org/>

View Sample Maps: <http://www.project2061.org/publications/toolWeb.htm>

Order through AAAS/Project 2061 or through the NSTA bookstore at <http://nsta.org>.

American Association for the Advancement of Science (1994). Benchmarks for science literacy. NY, NY: Oxford University Press.

Read Online: <http://www.project2061.org/publications/toolWeb.htm>

Order through AAAS/Project 2061 or through the NSTA bookstore at <http://nsta.org>

American Association for the Advancement of Science (1990). Science for all Americans. NY, NY: Oxford University Press.

Read Online: <http://www.project2061.org/publications/toolWeb.htm>

Order through AAAS/Project 2061 or through the NSTA bookstore at <http://nsta.org>

Bransford, J. D.; Brown, A. L.; and Cocking, R. R.; eds. (1999). How people learn: brain, mind, experience, and school. Washington, DC: National Academy Press.

Read Online: http://www.nap.edu/catalog.php?record_id=9853

Driver, R.; et al. (1994). Making sense of secondary science: research into children's ideas. NY, NY: Routledge Press.

Can be ordered through NSTA at the NSTA Bookstore at <http://nsta.org>

Hazen, R. and Trefil, J. (1991). Science matters; achieving scientific literacy. NY, NY: Anchor Books.

Order through NSTA at the NSTA Bookstore at <http://nsta.org>

Keeley, P. (2005). Uncovering student ideas in science (Vol. 1-4). United States: National Science Teachers Association.

Order through NSTA at the NSTA Bookstore at <http://nsta.org>

Keeley, P. (2005). Science curriculum topic study: bridging the gap between standards and practice. Thousand Oaks, CA: Corwin Press.

Order through NSTA at the NSTA Bookstore at <http://nsta.org>

McClellan, M.; Schneider, C. (2009). Washington state K-12 science learning standards. Olympia, WA: Office of the Washington Superintendent of Public Instruction.

Read Online: <http://www.k12.wa.us/Science/Standards.aspx>

National Research Council (1996). National science education standards. Washington DC: National Academy Press.

Read Online: <http://books.nap.edu/html/nses/>

Order through National Academy Press at <http://nap.edu> or through the NSTA bookstore at <http://nsta.org>

Naylor, S.; and Keogh, B. (2004). Concept cartoons in science education. Cheshire, UK: Millgate House Publishing and Consultancy Ltd.

GEMS Concept and Lesson Map: Space Science Sequence

The Big Picture

Using the Sun-Earth-Moon system as the foundation, the four units in this sequence build student understanding of scale in astronomy, the motions of objects in a planetary system and related concepts about gravity and the nature of light and shadow. The key space science concepts and inquiry skills that they learn in this sequence prepare students to investigate and understand more complex space science concepts in middle school and beyond.

Unit 1: How Big and How Far?

To learn about scale in space, students measure models of the sizes and distances of familiar sky objects, including objects within the Earth’s atmosphere and in space. (Overview p. 8)

Class Sessions:

- 1.1 Thinking about space. (60 min)
- 1.2 What in the sky? (60 min)
- 1.3 Measuring sizes of objects? (60 min)
- 1.4 How big are the Earth, Moon, and Sun? (60 min)
- 1.5 Sizes near and far. (60 min)
- 1.6 Ranking space objects by size. (60 min)
- 1.7 How far away are they? (60 min)
- 1.8 Comparing distances. (60 min)
- 1.9 How our scale ideas have changed. (60 min)

Overarching Question:

- How do the sizes of the Sun, the Earth, and the Moon compare?
- How do the distances between the sun, the Moon, and the Earth compare?
- How do models help scientists understand these comparisons?

See page 94 for session summaries.

See pages 10-11 for conceptual progression.

Unit 2: Earth’s shape and gravity.

To understand the Earth’s spherical shape and basic ideas about gravity. Students use models, gather evidence from images, and discuss interesting thought-experiments. (Overview p. 8)

Class Sessions:

- 2.1 Ideas about Earth’s shape and gravity. (60 min)
- 2.2 What shape is the Earth? (60 min)
- 2.3 Gravity. (60 min)
- 2.4 Weightlessness. (60 min)
- 2.5 Gravity and Air. (60 min)
- 2.6 Gravity beyond Earth. (60 min)

Overarching Question:

- What shape is the Earth?
- What does gravity do?

See page 240 for session summaries.

See pages 10-11 for conceptual progression.

Unit 3: How does the Earth move?

This unit focuses on how the rotation of the Earth causes the apparent movement of the sun as well as night and day. (Overview p. 8)

Class Sessions:

- 3.1 Ideas about the Earth and Sun. (60 min)
- 3.2 Mount Nose. (60 min)
- 3.3 Spinning Earth. (60 min)
- 3.4 Earth in orbit. (60 min)

Overarching Questions

- How does the Earth move?

See page 356 for session summaries.

See pages 10-11 for conceptual progression.

Unit 4: Moon phases and eclipses. (Optional)

Students make observations of the moon in the sky and notice patterns in the moon’s cycle of phases. They explore light and shadow and learn that shadows are not just two dimensional. (Overview p. 8)

Class Sessions:

- 4.1 Observing the moon. (40 min session *and* six observations)
- 4.2 Finding the patterns in moon observations. (60 min)
- 4.3 Understanding moon phases. (60 min)
- 4.4 Understanding eclipses of the moon and sun. (60 min)
- 4.5 Impossible missions. (60 min)

Overarching Questions for 4.1-4.2
What are shadows?

Overarching Questions for Unit 4:
Why do we have moon phases and eclipses?

See page 412 for session summaries.

This unit covers some standards that are in the Washington State 6-8 grade band. National standards place these concepts in the 5-8 grade band. So only parts 4.1 and 4.2 is appropriate for most K-4 students.

See pages 10-11 for conceptual progression.